Variations in parental monitoring and predictions of adolescent prescription opioid and stimulant misuse

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Abstract

Objective—This study examined relations between adolescents' family structures, social ties, and drug-related attitudes, and their misuse of prescription opioids and stimulants. Different relationships were anticipated for the substances based on prior research highlighting varying motivations for their use.

Method—Based on an earlier model of adolescent substance misuse, two path analytic models were tested using data from 12 to 17 year olds in the 2012 U.S. National Survey on Drug Use and Health (NSDUH: N = 17,399).

Results—Female respondents reported higher levels of parental warmth, as did youth from wealthier families. Greater parental monitoring was reported by adolescents from wealthier and intact families. Parental monitoring and warmth predicted adolescents' social ties and individual differences associated with drug use, and both variables predicted prescription opioid and stimulant misuse. Contrary to previous research, for adolescents aged 12 to 14, high levels of parental monitoring, while positively associated with attitudes and social ties, also predicted higher rates of prescription stimulant misuse when combined with low levels of parental warmth. Results were cross-validated with data from the 2011 NSDUH.

Conclusions—Analyses highlighted the importance of understanding and differentiating the underlying factors associated with adolescent prescription stimulant and opioid misuse, and the role of parental behaviors in prevention.

Keywords

Nonmedical use; Adolescents; Stimulants; Opioids; Parental monitoring; Parental warmth

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1. Introduction

Adolescents' nonmedical use of prescription medications (NUPM) has become an escalating public health concern in the United States. Prescription opioids (e.g., Vicodin, Oxycontin) and stimulants (e.g., Ritalin, Adderall) are among the most commonly used types of prescription medications (NIDA, 2012), and millions of 12–18 year olds misuse them recreationally each year (SAMHSA, 2013). Although legal, prescription medications' high potential for abuse combined with their easy access has captured the attention of many prevention scientists (e.g., Cranford, McCabe, & Boyd, 2013; McCabe & Boyd, 2012; McCabe & Cranford, 2012; McCabe, Teter, & Boyd, 2004, 2006; Nakawaki & Crano, 2012), as their misuse is not only detrimental to health, but can lead to death (Gould et al., 2009).

Problem behavior theory (PBT; Jessor, 1992; Jessor & Jessor, 1977) provides a framework to research adolescent NUPM. The theory holds that problem behavior emerges as a function of three integrated psychosocial systems: the personality, perceived environment, and behavior systems. PBT has been used to investigate youths' susceptibilities to many problem behaviors, including substance use (Donovan, 1996; Jessor, 1987). Hemovich, Lac, and Crano (2011) used PBT to model the association of individual and environmental factors with adolescents' alcohol, cigarette, and marijuana use. Their analyses revealed that adolescents' perceived levels of parental monitoring and warmth predicted the conventionality of their friendship groups and their drug-relevant attitudes, which anticipated substance use or abstinence one year later.

In the perceived environment system, adolescent drug use is theoretically affected by family structure (i.e., dual-, single-, or neither-parent household) and family income (Rankin & Wells, 1994). Youth living with only one parent tend to be more resource deprived (Snyder, McLaughlin, & Findeis, 2006), more vulnerable to peer influence (Hoffman, 1995), experience less parental supervision (Astone & McLanahan, 1991), and to have weaker emotional connection with parents (Amato, 2005) than adolescents from dual parent families.

Average family income is significantly lower in single-parent households, and also predicts adolescent substance misuse (Bachman, Coley, & Carrano, 2012). Hemovich et al. (2011) suggested that the financial stress associated with single-parent family arrangements often required custodial parents to work, rendering them less available to monitor children. In addition, they identified sex as an indirect predictor of drug use, as boys experienced lower levels of monitoring and supervision. Income also may be associated with parental warmth, as distressed parents have been shown to be less engaged and affectionate during parent–child interactions (Mistry, Vandewater, Huston, & McLoyd, 2002).

Problem behaviors may result from these factors, as parental monitoring and warmth mitigate youths' engagement in many delinquent behaviors (Crano, Gilbert, Alvaro, & Siegel, 2008; Lac, Alvaro, Crano, & Siegel, 2009; Lac & Crano, 2009). Poor parental monitoring is predictive of many negative youth outcomes, including maladjustment (Kerr & Stattin, 2000), association with deviant peers (Snyder, Dishion, & Patterson, 1986), and poor

performance in school (Crouter, MacDermid, McHale, & Perry-Jenkins, 1990). Low parental warmth is linked to adolescents' inability to express positive emotions effectively (Davidov & Grusec, 2006), psychological instability (Suchman, Rounsaville, DeCoste, & Luthar, 2007), and emotional distress (Operario, Tschann, Flores, & Bridges, 2006).

Adolescents' social environments also play crucial roles in the perceived environment system. Peer influence typically increases during adolescence, but some circumstances may encourage youth to become especially reliant on peers to determine normatively appropriate behavior (Andrews, Tildesley, Hops, & Li, 2002). Poorly monitored youth may be more likely to acquire tolerant beliefs toward peer substance use (Martino, Collins, Ellickson, Schell, & McCaffrey, 2006), to have close friends who use drugs (Prinstein, Boergers, & Spirito, 2001), and to initiate or increase substance use when associating with substance using peers (Kandel, Kessler, & Margulies, 1978).

Sensation seeking, characterized as a need for experiences that are varied, novel, complex, and intense (Zuckerman, 2007, p. 49), falls under PBT's personality system. It has been linked to many dangerous behaviors, including hazardous driving (Dahlen, Martin, Ragan, & Kuhlman, 2005), binge drinking (Johnson & Cropsey, 2000), illicit substance use (Donohew et al., 1999), and NUPM (Weyandt et al., 2009). Other risk factors from PBT's personality system include unfavorable school attitudes, poor academic motivation and achievement, and low perceptions of behavioral risk, all of which have been related to substance use (e.g., Hallfors et al., 2002; Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2014; Siegel et al., 2014). A related risk factor from the behavioral system is adolescent delinquency, which has been identified as a strong predictor of substance use (D'Amico, Edelen, Miles, & Morral, 2008). Presumably, adolescents engaged with school are less likely to be distracted by delinquent behavior and substance use (Brophy, 1996).

The current study was designed to test whether the PBT-based model Hemovich et al. (2011) used with cigarettes, alcohol, and marijuana might also fit nonmedical use of prescription opioids and stimulants. Research suggests marked differences in motivation for nonmedical use of prescription opioids versus prescription stimulants. Prior studies suggest that prescription opioid misuse may be motivated predominantly by pain relief, coping with stress, aiding sleep, reducing depression and anxiety, and getting high (Boyd, McCabe, Cranford, & Young, 2006; Boyd, Young, Grey, & McCabe, 2009; McCabe, Boyd, Cranford, & Teter, 2009; McCabe & Cranford, 2012), many of which are substantially similar to motivations for cigarette, alcohol, and marijuana use (Comeau, Stewart, & Loba, 2001). As such, Hemovich et al. (2011) model is expected to fit for prescription opioid misuse.

In contrast, prescription stimulant misuse typically is motivated by a desire to increase concentration, alertness, and energy, and to stay awake (Boyd et al., 2006, 2009; McCabe & Cranford, 2012). Moreover, although parental involvement can attenuate illicit drug use, research suggests that parental pressures, expectancies, and behaviors sometimes may exacerbate problematic substance use (Lamb & Crano, 2014; Miller, Siegel, Hohman, & Crano, 2013). Achievement-oriented psychological control (APC; Soenens, Vansteenkiste, & Luyten, 2010) refers to parenting behavior that negatively affects healthy adolescent development. Parents high in APC view poor performance as a threat to their self-worth and

pressure their children to excel academically. They communicate unrealistic demands for achievement and manipulate youth when they fail to achieve academic success (Soenens et al., 2010). APC is related to several problems in adolescence, including anxiety (Duchesne & Ratelle, 2010), self-criticism (Soenens et al., 2010), depression (Barber, 1996), low self-esteem (Barber & Harmon, 2002), and delinquency (Pettit, Laird, Bates, Dodge, & Criss, 2001). Parents who monitor their children closely and continually pressure them to attain unrealistic academic standards may unintentionally increase the likelihood of their child's misusing prescription stimulants to improve academic performance. As such, much of Hemovich et al. (2011) model would remain intact, but high parental monitoring also may directly increase the odds of adolescent stimulant misuse, whereas it would not for opioids. Teter, McCabe, Boyd, and Guthrie (2003) indirectly supported this hypothesis; their study showed that students with higher family incomes reported higher rates of nonmedical stimulant use. Since high family income is associated with higher levels of parental monitoring (Hemovich et al., 2011), Teter et al. (2003) results indirectly support the possibility that strong parental monitoring may foster adolescents' predispositions to misuse prescription stimulants.

2. Method

A series of path analyses were fitted using the 2012 National Survey of Drug Use and Health (NSDUH), each a representative cross-sectional sample of noninstitutionalized, community-dwelling civilians aged 12 and older in the United States. The NSDUH uses a multistage area probability design with demographic stratification. Sampling weights allow post-stratification adjustments for nonresponse and coverage. More information about the study's design and data collection procedures may be found elsewhere (SAMHSA, 2013).

The NSDUH measures encompass variables related to risk and protective factors for substance use (Hawkins, Catalano, & Miller, 1992) drawn from multiple sources, including the Monitoring the Future survey (e.g., Johnston, O'Malley, Schulenberg, & Bachman, 2006), the Connecticut Substance Abuse Prevention Student Survey (e.g., Delaronde, Cook, Ungemack, & Stanger, 1997), and instruments developed by the Social Development Research Group (e. g. Arthur, Hawkins, Pollard, Catalano, & Baglioni, 2002). Measures used in NSDUH have been used broadly in previous studies and have demonstrated reliability and validity (SAMHSA, 2010). In this study, mean composites were created for parental monitoring, parental warmth, social ties, and interpersonal factors. Summary information for all measures and their use in prior studies is outlined in Table 2.

Since adolescents undergo considerable developmental change across this age range that may differentially affect risk and protective factors, the sample was split into smaller age groups. To avoid reducing sample sizes too dramatically, the sample was split into a younger group aged 12–14 and an older group aged 15–17, for which models were fitted separately. Owing to the complex sampling scheme, probit path analyses were weighted and conducted using the WLSMV estimator in Mplus 7.2. To test the model used by Hemovich et al. (2011), separate path analytic models were constructed for both age groups and prescription substances, using data from the 2012 NSDUH. Having low family income, being male, and coming from a neither- or single-parent household were hypothesized to predict lower

adolescent perceptions of parental monitoring and warmth, which should predict social ties and attitudes more lenient toward substance use, in turn predicting nonmedical use of opioids (Fig. 1). The model for stimulants is identical with one exception: it included an additional direct path from monitoring to stimulant misuse (Fig. 2). Results were the cross-validated with data from the 2011 NSDUH to ensure that the results were not specific to the 2012 sample.

To assess if the order of mediation was specified correctly and whether other models might fit equally well or better, alternative models were tested and compared with the original models. The selection of alternative models was straightforward—the positions of the first and second mediators in the model were reversed, so that individual factors and social ties predicted parental warmth and monitoring. Fit was compared using several common indices, including the χ^2 goodness of fit, Comparative Fit Index (CFI; Bentler, 1990), Tucker–Lewis Index (TLI; Tucker & Lewis, 1973), and Root Mean Square of Approximation (RMSEA; Steiger, 1990). With the chi-square, smaller values suggest better fit; with the CFI and TLI, values ranging from approximately .94 to 1.0 indicate good fit; and with RMSEA, a value of .05 or smaller indicates good fit (Kline, 2011).

Based on the path analytic results, a follow-up probit regression was undertaken to assess whether parental monitoring, warmth, and their interaction predict stimulant use. These analyses were weighted and conducted with Stata 12.

3. Results

The sample consisted of 17,399 respondents ranging in age from 12 to 17 years ($M = 14.54$, 95% CI = 14.50–14.58). Descriptive statistics for each age group can be found in Table 1. In the originally posited models (Figs. 1 and 2), sex, family structure, and income predicted parental warmth and monitoring, which in turn predicted individual difference factors and social ties. Attitudes and social ties then predicted stimulant and opioid misuse. These original models exhibited good fit for both opioids and stimulants (Table 3). The fit indices for both the original and alternative models are presented in Table 3. The alternative model fit indices suggested that altering the mediation order generally made the model fit worse, supporting retention of the original model in which parental warmth and monitoring predicted individual factors and social ties. The exception was for stimulant use in 12–14 year olds, for whom both models fit similarly.

The original path analytic models in Figs. 1 and 2 supported almost all of the hypothesized pathways. Family structure and family income consistently predicted perceptions of parental monitoring. Adolescents from high income, dual-parent families were more likely to report greater parental monitoring. Surprisingly, child's sex did not significantly predict parental monitoring. Both family income and sex significantly predicted parental warmth; female adolescents from high-income families reported the highest levels of parental warmth. Family structure did not consistently predict parental warmth across all age groups and years. Low parental monitoring and warmth significantly predicted pro-substance attitudes and social ties.

The opioid model (Fig. 1) demonstrated that pro-substance social ties and attitudes predicted higher levels of lifetime nonmedical use of prescription opioids. These same relations were found in the stimulant misuse model, but in addition, lower perceived levels of parental monitoring, along with pro-substance social ties and attitudes significantly predicted stimulant misuse for respondents. In all models, the indirect effects of income, sex, and family structure on opioid and stimulant misuse were statistically significant, indicating that youths' social ties and substance-relevant attitudes operated as mediators in carrying these effects. Together, these findings support the hypotheses and point to important predictors of adolescents' misuse of prescription stimulants and opioids.

3.1. Auxiliary analysis

Results of the follow-up probit regression revealed a significant interaction of parental monitoring and warmth on stimulant misuse for younger adolescents, ages 12 to 14 ($t = -2.08$, $b = -.189$, $p = .042$): Younger respondents experiencing stringent parental monitoring and low warmth were more likely to use prescription stimulants nonmedically (Fig. 3). This pattern was replicated with the 2011 sample ($t = -1.93$, $b = -.119$, $p = .042$; Fig. 4). This significant interaction was not found in older participants, ages 15–17, in either the 2011 or the 2012 analyses.

Different results were found for opioid misuse. A significant two-way interaction between monitoring and warmth predicted opioid misuse for 12–14 year olds in 2011 ($t = -2.42$, $b = -.112$, $p = .019$; Fig. 5), with the highest probabilities of use associated with high monitoring/low warmth and low monitoring/high warmth. However, this interaction was not present in the 2012 sample, nor was it found for older respondents.

4. Discussion

Using two PBT-based models, this research was designed to provide information on the relations among environmental and individual difference factors associated with adolescents' misuse of different types of prescription medications. Family structure, income, and respondent sex were expected to affect parental monitoring and warmth, which were hypothesized to influence adolescents' social ties and attitudes towards substance use. The hypotheses were largely supported, as family structure and family income significantly anticipated levels of parental monitoring, with respondents from dual-parent, high-income families more likely to experience higher levels of monitoring. Contrary to previous research (e.g., Hemovich et al., 2011), gender did not significantly predict parental monitoring. Family income and sex significantly predicted parental warmth, with females and respondents from high-income families more likely to experience higher levels of warmth. In turn, low parental monitoring and warmth significantly predicted pro-substance attitudes: youth who experienced lower levels of monitoring and warmth reported having friends and attitudes more favorably oriented to nonprescription use of stimulants and opioids.

Based on the type of prescription medication misused, associations among predictors were expected to vary. Patterns among opioid misuse predictors were expected to be almost identical to those involving marijuana, alcohol, and cigarette use found previously (Hemovich et al., 2011). This expectation was confirmed: the fit indices of the theoretical

model of Fig. 1 were satisfactory (see Table 2), and most of the hypothesized pathways were significant and in the expected directions.

Relations among the predictors of stimulant misuse were hypothesized to function similarly to those associated with opioid misuse. In addition, a direct path between parental monitoring and stimulant misuse was posited, as prior research suggests that motivations associated with prescription stimulant misuse often are academically driven (Boyd et al., 2006). It was postulated that parents who closely monitored their children (and thus, may have pressured them to meet overly ambitious academic standards) might inadvertently have pushed them into prescription stimulant misuse to improve academic performance. Parental monitoring and warmth were predicted to foster anti-substance use attitudes and social ties, and both variables operated as hypothesized. Further, a direct path between parental monitoring and stimulant misuse was predicted, with higher levels of monitoring predicting higher probability of misuse. The path models did not support this hypothesis. Higher levels of monitoring predicted lower levels of stimulant misuse.

A reconsideration of the relationship between monitoring and stimulant misuse revealed that variations in parental warmth did affect the ways in which parental monitoring influenced stimulant misuse for younger respondents (ages 12 to 14). Strict monitoring combined with low warmth may have pushed adolescents toward stimulant misuse. The literature supports the possibility that strict monitoring and inadequate warmth may affect younger adolescents most, as youth become less reliant on parental influences as they get older (e.g., Andrews et al., 2002). For younger respondents, high levels of parental monitoring, while having a positive effect on social ties and drug-related attitudes, also had a negative effect when combined with low warmth. The combination of these variables was linked to *increased* levels of prescription stimulant misuse. This relationship was different for prescription opioid misuse, suggesting that monitoring and warmth differentially affect misuse of these substances.

The findings supply potentially useful insights into adolescent NUPM; however, the study also contended with several limitations. Due to the cross-sectional, correlational nature of the data, true causal inferences cannot be made with high confidence. Owing to the nature of secondary data, the researchers could not control the specific questions used in surveying respondents. Thus, each measure may have missed the mark to some extent, weakening the overall results. In particular, opioid- and stimulant-specific attitudes and norms would no doubt have produced stronger relationships to their respective substance uses than did attitudes and norms concerning tobacco, alcohol, and marijuana use. Still, because prior research has demonstrated relationships between these attitudes and prescription drug use (e.g., Schepis & Krishnan-Sarin, 2008), their inclusion in the models seemed reasonable, if not ideal.

The self-report measures employed also may represent a study limitation. As substance misuse is illegal and can lead to arrests or stigmatization, the validity of such self-reports may be questioned (Morral, McCaffrey, & Chien, 2003). However, several researchers maintain that the validity concerns of underreporting substance use are minor and unlikely to affect study results (Cornelius, Leech, & Goldschmidt, 2004; Fendrich, Mackesy-Amiti,

Johnson, Hubbell, & Wislar, 2004). The study also could not measure each respondent's specific motivations for prescription stimulant and opioid misuse; that is, the relationship between specific predictor variables and substance use could not be analyzed as a function of the specific motivational factors driving the behavior. However, based on previous findings (e.g., Boyd et al., 2006), we can reasonably assume that academic concerns were plausible drivers of stimulant misuse, at least for some respondents. The relatively low prevalence of NUPM among 12–14 year olds could also arguably be a limitation, though it does not diminish the importance of the results, especially given that even a small percentage of the subpopulation represents a large (absolute) number of adolescent users nationwide.

These limitations may be at least partly offset by the strengths of the study. Notably, the study benefits from a nationally representative sample that could not have been collected without massive federal support. The cross-validation results also represent an especially important strength. Issues with replicability and generalizability are perpetually ongoing issues in research (Shadish, Cook, & Campbell, 2002). While the study's representative design offers a reasonable address to generalizability concerns at a given time point, replicating the analyses with the 2011 NSDUH offers supporting evidence for the stability of these results.

5. Conclusion

Based on a representative sample of U.S. adolescents, this study may supply useful insights for prevention research. Beyond considering prescription misuse within a broader constellation of variables, the study also provides evidence that high levels of parental monitoring may not always be beneficial, as high monitoring combined with low warmth predicted higher rates of younger adolescents' misuse of prescription stimulants. The research suggests that well-designed prevention campaigns might profitably focus on educating parents about the stressors faced by youth in today's society, and the ways in which stringent parenting practices might have negative effects on adolescent development if not coupled with warmth. Such a campaign could encourage parents to address issues of NUPM with their children. As an added benefit, persuasive information presented in campaigns aimed at parents is less likely to be resisted by adolescents, and thus, may prove effective in preventive persuasion applications for adolescents (see Crano, Siegel, Alvaro, & Patel, 2007). Adopting a parent-targeted strategy could substantially improve the efficacy of future interventions.

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HIGHLIGHTS

- Monitoring and warmth predicted youths' social ties and attitudes toward drug use.

- Social ties and attitudes predicted prescription opioid and stimulant misuse.

- Warmth and monitoring interacted on stimulant misuse for younger users.

- High monitoring with low warmth led to more misuse for younger users.

- Results from the 2012 NSDUH were cross-validated with data from the 2011 NSDUH.
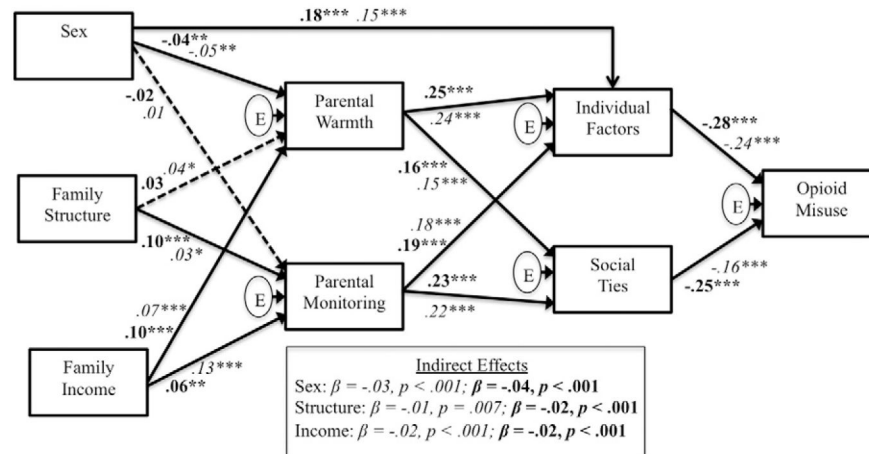
Fig. 1.
Path analytic model of variables theorized to predict adolescent prescription opioid misuse. Bold *β* weights represent participants ages 15–17; italicized *β* weights represent respondents ages 12–14. For diagrammatic clarity, the correlation of error terms between monitoring and warmth (*r* = .35, *p* < .001) and between social ties and individual factors (*r* = .47, *p* < .001) is not displayed. *Note:* Solid paths are statistically significant for all respondents; values are standardized *β* weights; *p* < .05*, *p* < .01**, *p* < .001***.
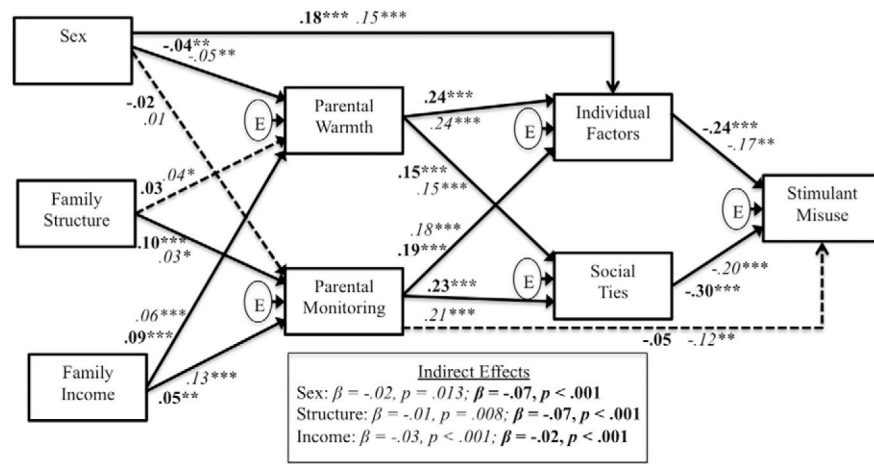
Fig. 2.
Path analytic model of variables theorized to predict adolescent prescription stimulant misuse. Bold β weights represent participants ages 15–17; italicized β weights represent respondents ages 12–14. For diagrammatic clarity, the correlation of error terms between monitoring and warmth (r = .35, p < .001) and between social ties and individual factors (r = .47, p < .001) are not displayed. *Note:* Solid paths are statistically significant for all respondents; values are standardized β weights; p < .05*, p < .01**, p < .001***.
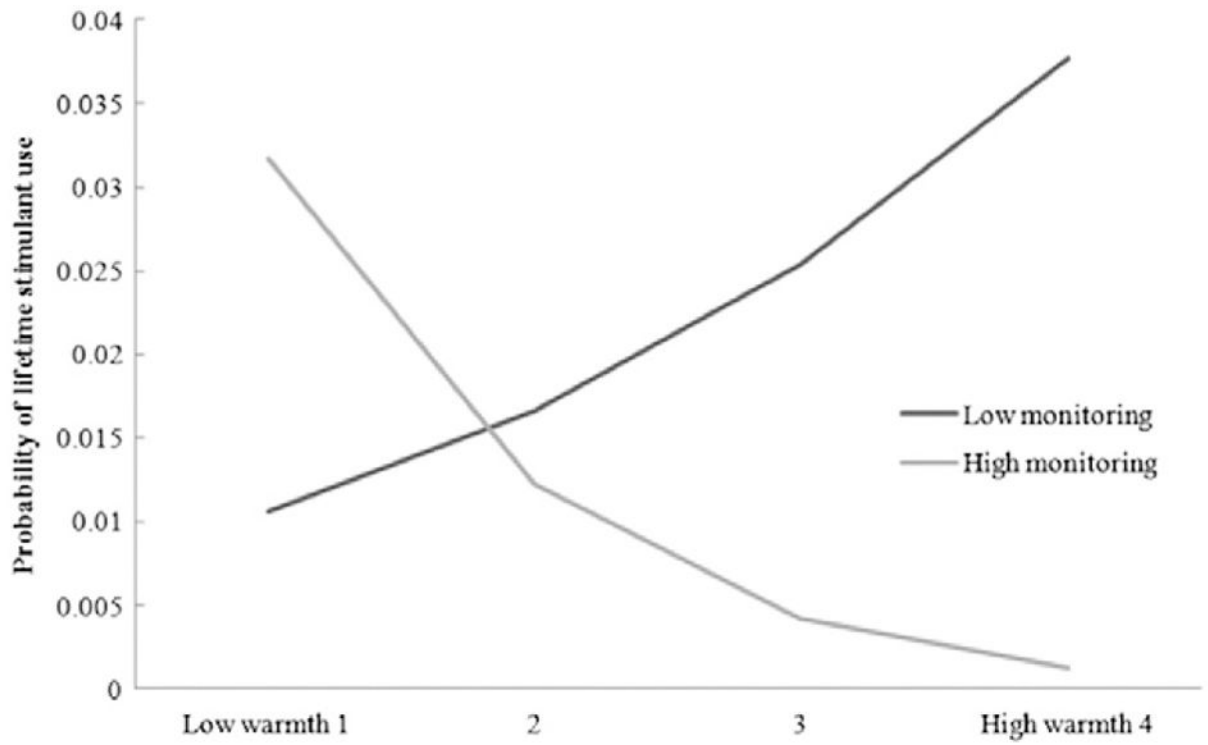
Fig. 3.
Interaction of parental monitoring and parental warmth predicting adolescent stimulant misuse for 12–14 year olds in 2012.
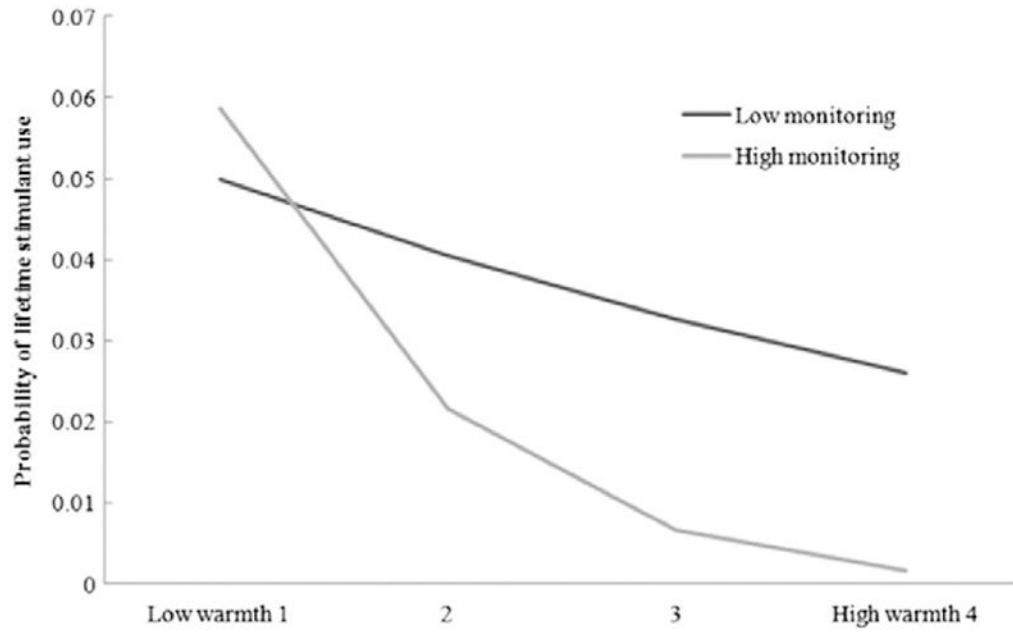
Fig. 4.
Interaction of parental monitoring and parental warmth predicting adolescent stimulant misuse for 12–14 year olds in 2011.
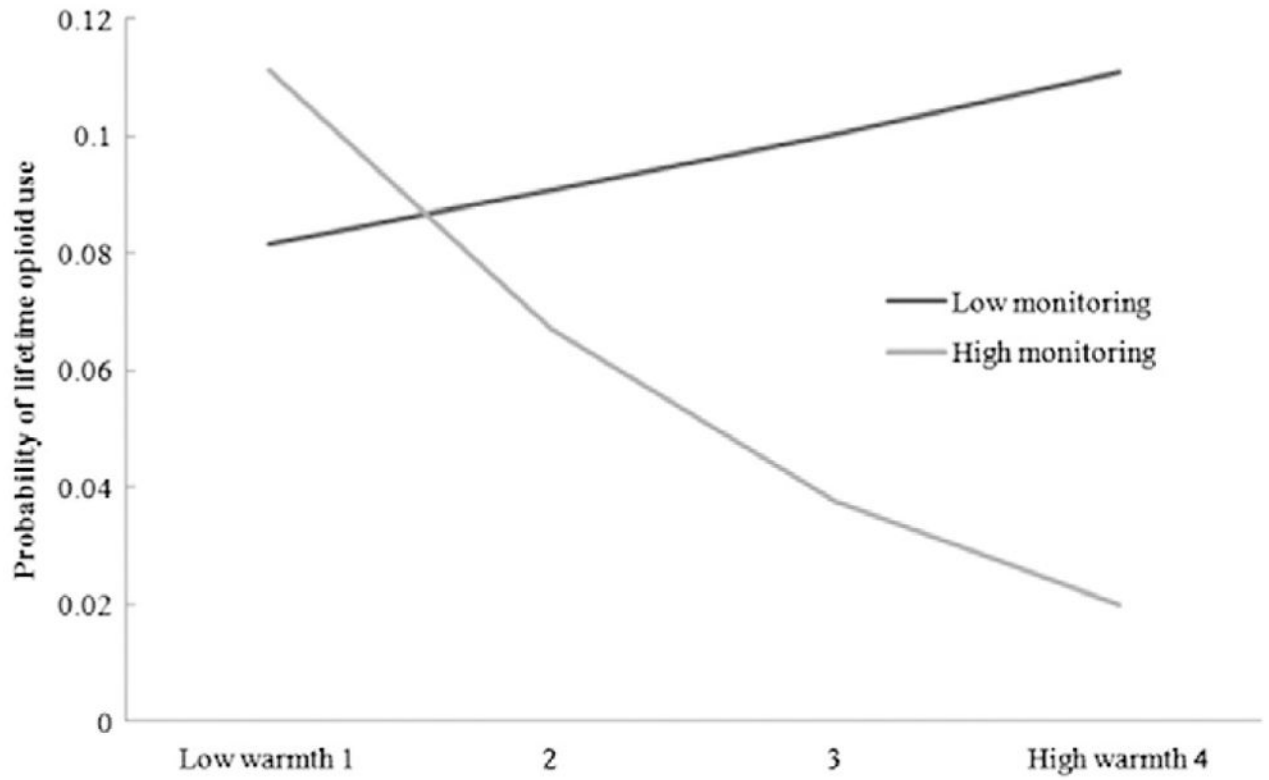
Fig. 5.
Interaction of parental monitoring and parental warmth predicting adolescent opioid misuse for 12–14 year olds in 2011.

Table 1

Descriptive statistics for the 2012 NSDUH adolescents ($n = 17,399$).

		12–14 year old subsample	15–17 year old subsample
Female		48.9%	48.9%
Age	12	32.6%	15 32.3%
	13	33.1%	16 33.8%
	14	34.3%	17 33.9%
Race	White/Caucasian	54.4%	56.2%
	Black/African American	14.2%	14.2%
	Hispanic/Latino	22.5%	21.4%
	Native American/AK Native	0.8%	0.5%
	Asian/Pacific Islander	5.2%	5.0%
	Multiracial	3.0%	2.7%
Family income	<$20,000/year	18.5%	17.9%
	$20,000–$49,999	29.7%	30.0%
	$50,000–$74,999	17.0%	16.2%
	$75,000+	34.9%	35.9%
Parental status	Dual parent household	71.3%	69.1%
	Single parent household	25.5%	26.9%
	Neither parent present	3.3%	4.1%
Used opioids nonmedically		4.4%	11.7%
Used stimulants nonmedically		0.7%	3.1%

Note: Percentages reflect weighted estimates.

Table 2

Summary measure information.

Measure	Prior use	Scale range	Sample items	α	M	SE
Demographic characteristics						
Sex (1 item)		**0 (*Female*) and 1 (*Male*)**		—	—	—
Family structure (1 item)		**1 (*Neither-parent*), 2 (*Single-parent*), 3 (*Dual-parent*)**		—	**2.67**	**.01**
Family income (1 item)		**1 (*Less than $20,000*) to 4 (*$75,000 or more*)**		—	**2.74**	**.02**
Parental monitoring (4 items)	b, c, f, g, h	1 (*Never*) to 4 (*Always*)	How often do your parents limit the amount of time you go out with friends on school nights?	.65	2.91	.01
Parental warmth (2 items)	b, c, f, g, h	1 (*Never*) to 4 (*Always*)	How often do your parents tell you they are proud of you for something you have done?	.86	3.36	.01
Social ties (12 items total)				.74	2.69	.01
Peer substance use norms (4 items)	a, c, d	1 (*All of them*) to 4 (*None of them*)	How many of the students in your grade at school would you say drink alcoholic beverages?	.88	2.98	.01
Close friends' approval of substance use (4 items)	a, c, d	1 (*Neither approve or disapprove*) to 3 (*Strongly disapprove*)	How do you think your close friends would feel about you trying marijuana or hashish once or twice?	.90	2.51	.01
Personal approval of substance use (4 items)	a, d	1 (*Neither approve or disapprove*) to 3 (*Strongly disapprove*)	How do you feel about someone your age trying marijuana or hashish once a month or more?	.89	2.55	.01
Individual factors (22 items total)				.60	3.20	.00
Parent substance use disapproval (4 items)	a	1 (*Neither approve or disapprove*) to 3 (*Strongly disapprove*)	How do you think your parents would feel about you having one or two drinks of an alcoholic beverage?	.85	2.88	.01
School engagement (4 items)	a, g	4 (*Not engaged*) to 1 (*Very engaged*)	How have you felt overall about going to school during the past 12 months?	.77	3.17	.01
Academic achievement (1 item)	a, g	4 (*D or less than D*) to 1 (*A+, A, or A−*)	What were your grades for the last semester or grading period you completed?	–	3.06	.01
Sensation seeking (2 items)	g, h	1 (*Always*) to 4 (*Never*)	How often do you get a real kick out of doing things that are a little dangerous?	.82	2.95	.01
Perceived risk of use (5 items)	d	1 (*Great risk*) to 4 (*No risk*)	How much do people risk harming themselves physically and in other ways when they smoke one or more packs of cigarettes per day?	.72	3.20	.01
Delinquency (6 items)	a, g, h	1 (*0 times*) to 4 (*6 to 9 times*)	During the past 12 months, how many times have you gotten into a serious fight at school or work?	.70	3.90	.00
Prescription drug misuse						
Opioids (1 item)	e	0 (*No*) to 1 (*Yes*)	Have you ever, even once, used any type of prescription pain reliever/stimulant that was not prescribed for you or that you took only for the experience or feeling they caused?	–	.08	.00
Stimulants (1 item)	e	0 (*No*) to 1 (*Yes*)		–	.02	.00

Note. Means and standard errors reflect weighted estimates. Values in parentheses indicate the number of items that make up each measure. The prior use column indicates use of the measures in previous research: a = Chen, Balan, & Price, 2012; b = Herman-Stahl et al., 2008; c = Noyori-Corbett & Moon, 2010; d = Resnicow, Smith, Harrison, & Drucker, 1999; e = Schepis & Krishnan-Sarin, 2008; f = Vaughn et al., 2012; g = Vaughn, Maynard, Salas-Wright, Perron, & Abdon, 2013; h = Vaughn, Shook, Perron, Abdon, & Ahmedani, 2011.

Table 3

Fit indices for the original and modified models.

Age	Description	CFI	TLI	RMSEA [95% CI]	χ^2
Opioid misuse					
12–14	Original model	.972	.931	.035 [.029–.041]	$\chi^2(10) = 109.73, p < .001$
	Alternative model	.949	.873	.047 [.041–.053]	$\chi^2(10) = 192.66, p < .001$
15–17	Original model	.974	.935	.027 [.022–.033]	$\chi^2(10) = 75.92, p < .001$
	Alternative model	.830	.574	.069 [.063–.074]	$\chi^2(10) = 439.23, p < .001$
Stimulant misuse					
Age	Description	CFI	TLI	RMSEA [95% CI]	χ^2
12–14	Original model	.979	.943	.031 [.025–.037]	$\chi^2(9) = 79.58, p < .001$
	Alternative model	.978	.946	.030 [.024–.036]	$\chi^2(9) = 83.87, p < .001$
15–17	Original model	.975	.930	.027 [.021–.033]	$\chi^2(9) = 69.13, p < .001$
	Alternative model	.860	.651	.061 [.055–.066]	$\chi^2(9) = 341.74, p < .001$

Note. The original models reflect those presented in Figs. 1 and 2. In the alternative models, parental warmth and monitoring were switched with attitudes and social ties in the mediation chain.